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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/720,579

11/24/2003

Sangyum Kim

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EXAMINER

WONG, EDNA

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

05/06/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/720,579	<b>Applicant(s)</b> KIM ET AL.	
	<b>Examiner</b> EDNA WONG	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 23-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 23-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |                                                                                      |                                                                   |
|--------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____                                                          | 6) <input type="checkbox"/> Other: _____                          |

***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on April 24, 2008 has been entered.

This is in response to the Amendment dated April 24, 2008. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office Action.

***Response to Arguments***

Claim Objections

Claim **20** has been objected to because of minor informalities.

The objection of claim 20 has been withdrawn in view of Applicants' amendment. Claim 20 has been cancelled.

Claim Rejections - 35 USC § 112

Claim **22** has been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which

applicant regards as the invention.

The rejection of claim 22 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment. Claim 22 has been cancelled.

#### Claim Rejections - 35 USC § 103

Claims **16-22** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Wolski et al.** (US Patent No. 5,834,140) in combination with **Yates et al.** (US Patent No. 5,863,410) and **Merchant et al.** (US Patent No. 5,863,666).

The rejection of claims 16-22 under 35 U.S.C. 103(a) as being unpatentable over Wolski et al. in combination with Yates et al. and Merchant et al. has been withdrawn in view of Applicants' amendment. Claims 16-22 have been cancelled.

### ***Response to Amendment***

#### ***Claim Objections***

Claim **27** is objected to because of the following informalities:

#### Claim 27

line 1, it is suggested that the word -- wherein -- be inserted after the number "23,".

line 1, it is suggested that the word "having" be amended to the word -- has --.

Appropriate correction is required.

***Claim Rejections - 35 USC § 103***

Claims **23-31** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Wolski et al.** (US Patent No. 5,834,140) in combination with **Yates et al.** (US Patent No. 5,863,410), **Merchant et al.** (US Patent No. 5,863,666), **WO 01/53569 A1** ('569) and **Sekiguchi et al.** (US Patent No. 6,562,222 B1).

*Sekiguchi is the English equivalent of WO 01/53569.*

Wolski teaches a method for manufacturing an electrodeposited copper foil comprising:

- (a) forming an electrolyte solution **3** (= electrolyte) [col. 3, line 3] containing a sulfuric acid (col. 6, lines 53-56; and col. 8, lines 45-47) and a copper ion (= from copper sulfate) [col. 6, lines 53-56; and col. 8, lines 45-47] and a chloride ion (col. 6, lines 14-29);
- (b) adding to said electrolyte solution, additives consisting of 0.1 ppm to 100 ppm of gelatin (= 0.3 to 35 ppm by weight) [col. 5, lines 42-54; col. 6, lines 10-11; and col. 12, lines 41-43] and 0.05 ppm to 50 ppm of hydroxyethyl cellulose (= 0.1 to 15 ppm by weight) [col. 5, lines 18-30; col. 6, lines 9-10; and col. 8, line 50];
- (c) submerging a rotating drum **2** (= a drum-shaped cathode) and an anode plate **1** in said electrolyte solution **3**, said anode plate having a curved shaped and spaced by a distance from an outer surface of the drum (= provided to a concentric

circle shape to said cathode **2**) [col. 3, lines 3-13; and Fig. 1]; and

(d) applying a negative current (= cathode) to said drum **2** and a positive current (= anode) to said anode plate **1** so to deposit the copper foil **4** onto said outer surface of said drum (= to deposit copper on the surface of said cathode) [col. 3, lines 9-13].

The gelatin being an amount of between 2 ppm to 5 ppm (= 0.3 to 35 ppm by weight) [col. 5, lines 42-54; col. 6, lines 10-11; and col. 12, lines 41-43]

The hydroxyethyl cellulose being an amount of between 1 ppm to 3 ppm (= 0.1 to 15 ppm by weight) [col. 5, lines 18-30; col. 6, lines 9-10; and col. 8, line 50].

The deposited copper foil has a matte side and a shiny side (col. 3, lines 55-58).

The sulfuric acid being an amount of 50 to 200 g/l (= 110 g/l of sulfuric acid) and said copper ion being in an amount of 30 to 150 g/l (= 90 g/l of copper) [col. 8, lines 45-48].

The electrolyte solution being at a temperature of between 20 and 80°C (= 58°C) [col. 8, Table 1, "Temperature"].

The electrolyte has a negative current density of between 20 and 150 A/dm<sup>2</sup> (= 50 A/dm<sup>2</sup>) [col. 8, Table 1, "Current density"].

The method of Wolski differs from the instant invention because Wolski does not disclose the following:

a. Wherein the additive consists of 0.05 ppm to 20 ppm of

bis(sodiumsulfopropyl)disulfide, as recited in claim 23.

b.       Wherein said bis(sodiumsulfopropyl)disulfide is an amount of between 0.5 ppm to 3 ppm, as recited in claim 26

Wolski teaches that adding sodium 3-mercapto-1-propanesulfonate ( $\text{HS}(\text{CH}_2)_3\text{SO}_3\text{R}$ ) in combination of the high molecular weight polysaccharide and/or the low molecular weight glue and a minute amount of the chloride ion to the electrolyte, various characteristics required for a low-profile copper foil for fine patterning can be realized at a high level (col. 4, line 66 to col. 5, line 17; col. 6, lines 30-35 and col. 8, line 49).

Like Wolski, Yates teaches an electrolytic process for producing copper foil having a low profile surface (col. 1, lines 7-11).

Yates teaches that water soluble, sulfonated organic sulfur compounds form complex salts with metals, which is helpful in formation of stable interfacial films. **Many simple bivalent sulfur organic compounds possess similar ability** and thus be useful as additions agents in the electrodeposition of copper. These substances can belong to the group of **aliphatic thiols, R-SH**, sulfides,  $\text{R}^1\text{-S-R}^2$ , **disulfides, R<sup>1</sup>-S-S-R<sup>2</sup>**, as well as aromatic and heterocyclic thiols, sulfides and disulfides. Such substances have, usually, non-polar and hydrophobic molecules. **To make them useful as addition agents in electroplating they are sulfonated**, i.e., sulfonic acid group  $\text{SO}_3\text{H}$  is introduced into the structure of a molecule in place of a hydrogen atom. A preferred sulfur compound is sodium salt of mercaptoethane sulfonic acid (MES) [col. 10, line 55

to col. 11, line 15].

Like Yates, Merchant teaches an electrolytic process for producing copper foil (col. 3, lines 59-62).

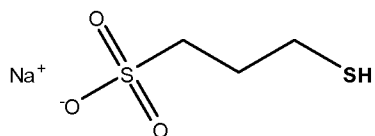
Merchant teaches that it is critical that the concentration of organic additives in the electrolyte solution be at least about 0.3 ppm. The organic additives can be one or more gelatins. The gelatins that are useful herein are heterogeneous mixtures of water-soluble proteins derived from collagen. Animal glue is a preferred gelatin. The organic additive can be selected from the group consisting of saccharin, caffeine, molasses, guar gum, gum arabic, thiourea, the polyalkylene glycols (e.g., polyethylene glycol, polypropylene glycol, polyisopropylene glycol, etc.), dithiothreitol, amino acids (e.g., proline, hydroxyproline, cysteine, etc.), acrylamide, sulfopropyl disulfide, tetraethylthiuram disulfide, alkylene oxides (e.g., ethylene oxide, propylene oxide, etc.), the sulfonium alkane sulfonates, thiocarbamoydisulfide, or derivatives or mixtures of two or more thereof. (col. 4, line 64 to col. 5, line 15).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the additive described by Wolski with wherein the additive consists of 0.05 ppm to 20 ppm of bis(sodiumsulfopropyl)disulfide; and wherein said bis(sodiumsulfopropyl)disulfide is an amount of between 0.5 ppm to 3 ppm because a disulfide would have been a functionally equivalent addition agent to the sulfonated organic sulfur compounds as taught by Yates (col. 10, line 55 to col. 11, line 15), and a sulfopropyl disulfide would have been an obvious disulfide to use in an

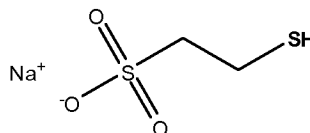


Art Unit: 1795

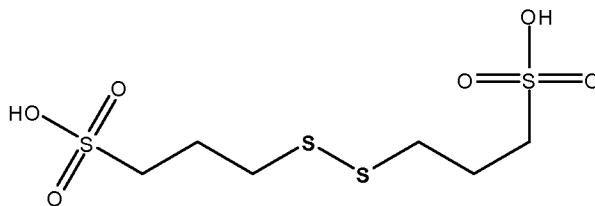
electrolytic process for producing copper foil as taught by Merchant (col. 4, line 64 to col. 5, line 15), and a bis(sodiumsulfopropyl)disulfide would have been an obvious sulfopropyl disulfide to use in an electrolytic process for producing copper foil because structural relationships may provide the requisite motivation or suggestion to modify known compounds to obtain new compounds (MPEP § 2144.09). See below:



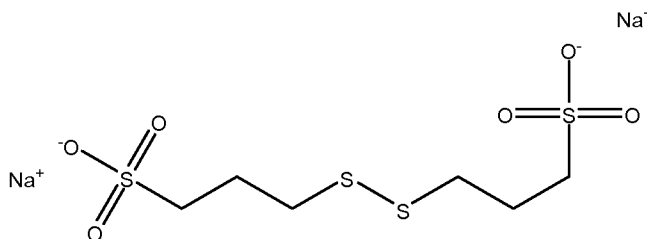
sodium 3-mercapto-1-propanesulfonic acid  
Wolski (col. 4, line 66 to col. 5, line 4; and  
col. 8, line 49)



sodium mercaptoethane sulfonic acid  
Yates (col. 11, lines 11-12)



sulfopropyl disulfide  
Merchant (col. 5, line 11)



sulfopropyl disulfide sodium salt  
Applicants' claim 23

Furthermore, Sekiguchi teaches the copper electroplating solution may contain

an organic sulfur compound. The organic sulfur compounds include, for example, bis-sulfo disulfide disodium salt, bis-(1-sulfomethyl) disulfide disodium salt, bis-(2-sulfoethyl) disulfide disodium salt, bis-(3-sulfopropyl) disulfide disodium salt, bis-(4-sulfobutyl) disulfide disodium salt, tetramethylthiuram disulfide, tetraethylthiuram disulfide, sodium 3-mercapto-1-propanesulfonate, and sodium 2,3-dimercapto-1-propanesulfonate (col. 5, lines 66 to col. 6, line 7).

c. Wherein the 0.1 ppm to 100 ppm of gelatin and 0.05 ppm to 50 ppm of hydroxyethyl cellulose and 0.05 ppm to 20 ppm of bis(sodiumsulfopropyl)disulfide is an additive, as recited in claim 23.

The Wolski combination teaches additives consisting of 0.1 ppm to 100 ppm of gelatin and 0.05 ppm to 50 ppm of hydroxyethyl cellulose and 0.05 ppm to 20 ppm of bis(sodiumsulfopropyl)disulfide.

The method of the Wolski combination differs from the instant invention because the Wolski combination does not disclose wherein the 0.1 ppm to 100 ppm of gelatin and 0.05 ppm to 50 ppm of hydroxyethyl cellulose and 0.05 ppm to 20 ppm of bis(sodiumsulfopropyl)disulfide is an additive.

The invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the additives described by the Wolski combination with wherein the 0.1 ppm to 100 ppm of gelatin and 0.05 ppm to 50 ppm of hydroxyethyl cellulose and 0.05 ppm to 20 ppm of

bis(sodiumsulfopropyl)disulfide is an additive because the selection of the any order of mixing ingredients is *prima facie* obvious (MPEP § 2144.04 (IV)(C)).

Furthermore, it has been shown that the transpositioning of varying steps, or varying the details of a process, as by adding a step or splitting one step into two does not avoid obviousness where the processes are substantially identical or equivalent in terms of function, manner and result. *General Foods Corp. v. Perk Foods Co.* (DC NIII 1968) (157 USPQ 14); *Malignani v. Germania Electric Lamp Co.*, 169 F. 299, 301 (D.N.J. 1909); *Matrix Contrast Corp. v. George Kellar*, 34 F.2d 510, 512, 2 USPQ 400, 402-403 (E.D.N.Y 1929); *Hammerschlag Mfg. Co. v. Bancroft*, 32 F. 585, 589 (N.D.III.1887); *Procter & Gamble Mfg. Co. v. Refining*, 135 F.2d 900, 909, 57 USPQ 505, 513-514 (4th Cir. 1943); *Matherson-Selig Co. v. Carl Gorr Color Gard, Inc.*, 154 USPQ 265, 276 (N.D.III.1967).

d.      Wherein said matte side has a roughness greater than a roughness of said shiny side, as recited in claim 27.

Wolski teaches that the untreated copper foil, the so-called shiny side which is a surface at the side of contacting with the drum has a relatively smooth surface, but at the reverse surface called a matte side, unevenness is relatively remarkable (col. 3, lines 55-58). The surface roughness of the untreated copper foil is almost determined by the electrolysis conditions when copper is deposited on the drum-shaped cathode, particularly by an additive to be added to an electrolyte (col. 3, lines 50-54).

The invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because the so-called shiny side which is a surface at the side of contacting with the drum would have had a relatively smooth surface, but at the reverse surface called a matte side, unevenness would have been relatively remarkable as taught by Wolski (col. 3, lines 55-58).

e. Wherein said gelatin has a molecular weight of greater than 10000, as recited in claim 28.

Wolski teaches that the commercially available products have weight average molecular weights (Mw) of 10,000 or less (col. 5, lines 42-54).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the molecular weight of the gelatin described by Wolski with wherein a molecular weight of the gelatin is above 10000 because a *prima facie* case of obviousness exists where claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties (MPEP § 2144.05(I)).

For example, a Mw of 10,000 versus a Mw of 10,001.

f. Wherein said chloride ion is in an amount of 200 mg/l, as recited in claim 29.

Wolski teaches that in order to produce a low-profiled copper foil in a broad

current density range stably, it is preferred to keep the amount in a range of 10 to 60 ppm. Even when the amount exceeds 60 ppm, low profiling can be effected (col. 6, lines 14-29).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the chloride ion described by Wolski with wherein said chloride ion is in an amount of 200 mg/l because when the amount exceeds 60 ppm, low profiling would have still been effected as taught by Wolski (col. 6, lines 14-29).

Furthermore, the concentration of chloride ions is a result-effective variable and one skilled in the art has the skill to calculate the concentration that would have determined the success of the desired reaction to occur, e.g., to produce a low-profiled copper foil in a broad current density range stably (MPEP § 2141.03 and § 2144.05(II)(B)).

***RE: REMARKS***

Applicants state that the step of “adding an additive” is not made obvious by the prior art combination because the composition is not disclosed.

Applicants state that none of the prior art references, individually, or in combination, recite an additive that is added to the electrolyte solution and that has this composition.

In response, the Wolski combination may not teach the multi-component additive

as presently claimed, however, the Wolski combination teaches all of the components of the additive, and the overall composition of the electrolyte solution used to deposit the copper foil would have been physically the same as presently claimed. The selection of any order of mixing ingredients is *prima facie* obvious (MPEP § 2144.04 (IV)(C)).

Applicants state that without this additive, the prior art combination would fail to achieve the advantages of the present invention.

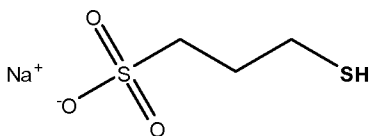
In response, if the overall composition of the electrolyte solution used to deposit the copper foil is physically the same, the composition must have the same properties. Products of identical chemical composition can not have mutually exclusive properties. A chemical composition and its properties are inseparable (MPEP § 2112.01(II)).

Furthermore, the reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

Applicants state that the disclosure of the group of bivalent sulfur organic compounds by the prior art does not make the particular selection of SPS obvious for patenting.

Art Unit: 1795

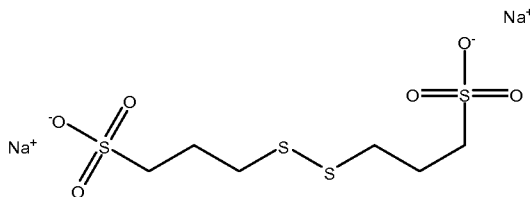
In response, Wolski teaches:



sodium 3-mercapto-1-propanesulfonic acid

Wolski (col. 4, line 66 to col. 5, line 4; and  
col. 8, line 49)

SPS would be the sodium 1-propanesulfonic acid constituent in double the proportion of the constituent:



sulfopropyl disulfide sodium salt

Applicants' claim 23

Yates teaches that thiols and disulfides are functional equivalents. Yates also teaches that the sulfonated forms of the thiols and disulfides make them useful as addition agents in electroplating. The sodium salt of the sulfonated forms is the preferred sulfur compound, preferably MES (col. 10, line 66 to col. 11, line 15).

Merchant teaches that sulfopropyl disulfide and sulfonium alkane sulfonates are functional equivalents (col. 4, line 64 to col. 5, line 15).

Sekiguchi teaches that bis-(3-sulfopropyl) disulfide disodium salt and sodium 3-mercapto-1-propanesulfonate are functional equivalents (col. 5, lines 66 to col. 6, line 7).

The Examiner notes that the substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In re Fount* USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. V. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Applicants state that although the Merchant patent discloses SPS, the Merchant patent does not teach the amounts and conditions of the SPS composition of the present invention.

In response, Merchant teaches that it is critical that the concentration of organic additives in the electrolyte solution be at least about 0.3 ppm, and in one embodiment in the range of about 0.3 ppm to about 10 ppm, and in one embodiment about 0.5 ppm to about 10 ppm, and in one embodiment, about 1 ppm to about 5 ppm, and in one embodiment from about 2 ppm to about 4 ppm (col. 4, line 64 to col. 5, line 2).

In the case where the claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists (MPEP § 2144.05).

A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention (MPEP §§ 2141.02, and 2123).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDNA WONG whose telephone number is (571) 272-



1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Edna Wong/  
Primary Examiner  
Art Unit 1795

EW  
May 5, 2008